بسم الله الرحمن الرحيم

Pain management in children

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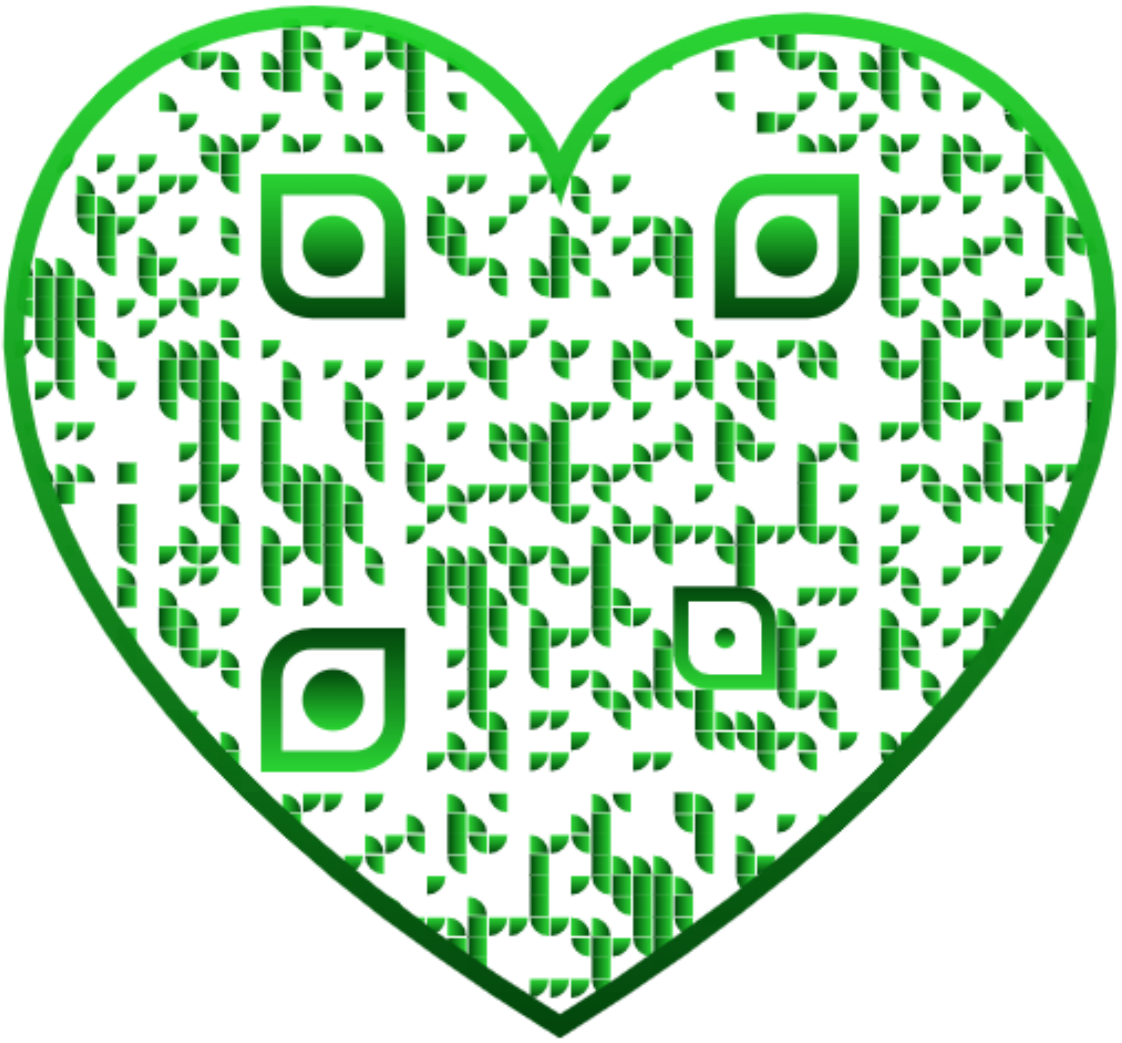


Case 1

- A 10-day-old baby, had a night crying for 3 days, she was breastfed and passed 2 soft motions per day with excessive reflux after each feed.
- How to assess the pain in this baby?
- How to reach the cause of this pain?
- How to manage this case?

Case 2

- A 6-year-old boy was brought to the hospital in coma after a full-down from the 3rd flour. He was irritable, dyspneic and afebrile. He was sedated and intubated.
- How to assess if this child had pain or now?
- How to manage the pain in this case?

Case 3

- A known case of Down syndrome had burn on his leg yesterday. The burn was due to hot tea, it was moderate, of second degree and 8% of dissemination.
- How to assess the degree of pain?
- How to manage this case?

Pain management

Assess the pain:

Presence

Degree

Cause

Treat the pain

DEFINITION AND CATEGORIES OF PAIN

"an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage."

(International Association for the Study of Pain (IASP)

CATEGORIES OF PAIN

Somatic

injury to or inflammation of tissues (e.g., skin, muscle, tendons, bone, joints, fascia, vasculature)

EXAMPLES: Burns, lacerations, fractures, infections, inflammatory conditions

In skin and superficial structures: sharp, pulsatile, well localized

In deep somatic structures: dull, aching, pulsatile, not well localized

Visceral

injury to or inflammation of viscera

EXAMPLES: Angina, hepatic distention, bowel distention or hypermobility, pancreatitis

Aching and cramping; nonpulsatile; poorly localized (e.g., appendiceal pain perceived around umbilicus) or referred to distant locations (e.g., angina perceived in shoulder)

Neuropathic

Injury to, inflammation of, or dysfunction of the peripheral or central nervous system

EXAMPLES: Complex regional pain syndrome (CRPS), phantom limb pain, Guillain-Barre syndrome, sciatica

Spontaneous; burning; lancinating or shooting; dysesthesias (pins and needles, electrical sensations); hyperalgesia (amplification of noxious stimuli); hyperpathia (widespread pain in response to a discrete noxious stimulus); allodynia (pain in response to nonpainful stimulation); pain may be perceived distal or proximal to site of injury, often corresponding to innervation pathways (e.g., sciatica)

Scale of pain

The Newborn and Infant

PHYSIOLOGIC CHANGES

- Increase in heart rate, respiratory rate, blood pressure, muscle tone
- Oxygen desaturation
- Sweating
- Flushing
- Pallor

BEHAVIORAL CHANGES

- Change in facial expression (grimacing, furrowing of the brow, nasal flaring, deep nasolabial groove, curving of the tongue, quivering of the chin)
- Finger clenching
- Writhing
- Head banging
- Sleep disturbance
- Thrashing of limbs
- Back arching
- Poor feeding

Neonate with pain

- **Behavioral Indicators**
- *Facial grimacing:* The Neonatal Facial Coding System uses several facial actions that may be indicators of pain. Pain is characterized by a bulging brow with tight creases in between; tightly closed eyelids; a deeply furrowed nasolabial groove; a horizontal, wide opened mouth; and a taut tongue that may be quivering along with the chin.
- *Crying:* May be an indicator of pain.
- *Activity:* Withdrawal or immobilization of a limb may be an indicator of pain.
- *Response to comfort measures:* Feeding, swaddling, holding, and ensuring that the infant is neither wet nor cold may help to discriminate between pain and other conditions.
- *Physiologic indicators:* Alterations in heart rate, blood pressure, SpO2, respiratory rate, or alterations in pattern of respiration may be nonspecific indicators of pain.

Table 93.4	CRIES Neonatal Pain Assessment Scale		
	0	**1**	**2**
Crying	No	High pitched but consolable	Inconsolable
Requires oxygen for saturation >95%	No	FiO_2 <30%	FiO_2 >30%
Increased vital signs	No	HR or BP <20%	HR or BP >20%
Expression	No	Grimace	Grimace and grunt
Sleepless	No	Wakes often	Constantly awake

Score <4 initiate nonpharmacologic measures
Score >4 initiate pharmacologic and nonpharmacologic measures
BP, Blood pressure; HR, heart rate.
From Davis PJ, Cladis FP, eds. *Smith's Anesthesia for Infants and Children,* 10th ed. Philadelphia: Elsevier; 2022, Table 23.2, p. 487.

Infant and child

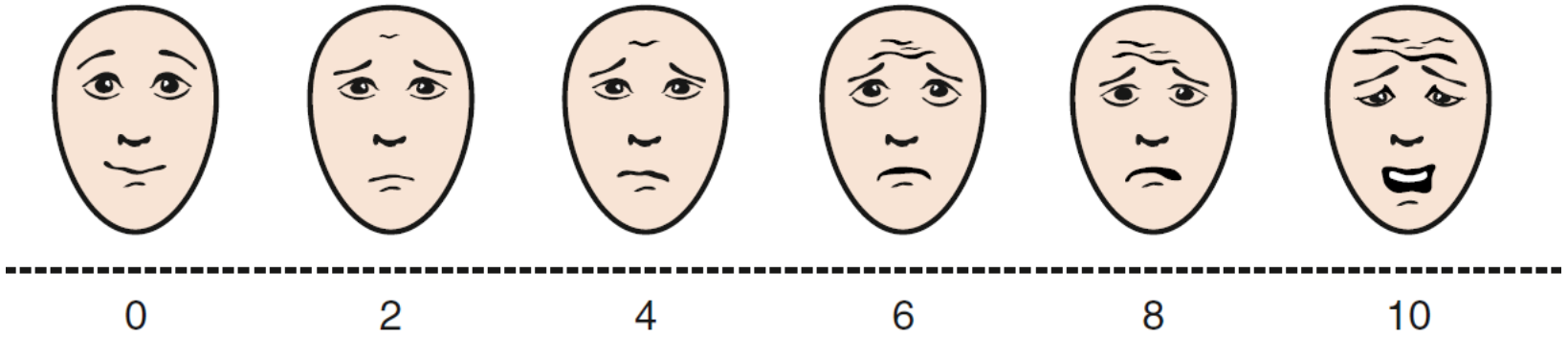
All age

Autonomic measures (e.g., HR, Bp..)

Hormonal-metabolic measures
Plasma or salivary sampling of "stress" hormones (e.g., cortisol, epinephrine)

3 years and more

Faces Scales



6 years and more

Visual Analog Scale (VAS)

0 ——————————— 10

Numerical Rating Scale (NRS)

0 -1-2-3-4-5-6-7-8-9-10

The Cognitively Impaired Child

- Children with trisomy 21 may express pain less precisely and more slowly than the general population.

- Pain in children with autism spectrum disorder (ASD) may be difficult to assess because these children may be both hyposensitive and hypersensitive to many different types of sensory stimuli, and they may have limited communication abilities.

Table 93.5	Revised FLACC for Pain Assessment in the Cognitively Impaired*		
	0	1	2
Face	No particular expression or smile	Occasional grimace/frown; withdrawn or disinterested (appears sad or worried)	Consistent grimace or frown; frequent/constant quivering chin, clenched jaw (distressed-looking face; expression of fright or panic)
Legs	Normal position or relaxed	Uneasy, restless, tense (occasional tremors)	Kicking or legs drawn up (marked increase in spasticity, constant tremors, or jerking)
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense (mildly agitated [e.g., head back and forth, aggression]; shallow, splinting respirations, intermittent sighs)	Arched, rigid, or jerking (severe agitation, head banging; shivering [not rigors]; breath-holding, gasping or sharp intake of breath; severe splinting)
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint (occasional verbal outburst or grunt)	Crying steadily, screams or sobs, frequent complaints (repeated outbursts, constant grunting)
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or talking; distractible	Difficult to console or comfort (pushing away caregiver, resisting care or comfort measures)

Treatment of Pain

Non-pharmacological treatment

Pharmacological treatment

Non-opioid treatment

Opioid treatment

Acetaminophen

- Safe, analgesic and antipyretic.
- No GIT or antiplatelet effects
- mild anti-inflammatory action.
- Acetaminophen toxicity

Aspirin

- indicated for certain rheumatologic conditions
- inhibition of platelet adhesiveness (Kawasaki disease)
- aspirin should not be used for routine pain control in children (Reye syndrome)

NSAIDs

- used for pain and fever
- Moderate to severe pain in association with opioid
- Juvenile idiopathic arthritis: ibuprofen and aspirin are equally effective.

Table 93.6 Commonly Used Nonopioid Medications (Antiinflammatory Medications)

MEDICATION	DOSAGE	COMMENT(S)
Acetaminophen	10-15 mg/kg PO q4h 10 mg/kg IV q4h 15 mg/kg IV q6h 10 mg/kg IV q6h (<2 yr) 20-30 mg/kg/PR q4h 40 mg/kg/PR q6-8h *Maximum daily dosing:* 75 mg/kg/24 hr (children) 60 mg/kg/24 hr (<2 yr) 30-45 mg/kg/24 hr (neonates)	Minimal antiinflammatory action; no antiplatelet or adverse gastric effects; overdosing can produce fulminant hepatic failure.
Ibuprofen	8-10 mg/kg PO q6h 10 mg/kg IV q4-6h to maximum of 400 mg *Maximum daily dose:* 2,400 mg	Antiinflammatory; transient antiplatelet effects; may cause gastritis; extensive pediatric safety experience.
Naproxen	5-7 mg/kg PO q8-12h *Maximum daily dose:* 1,000 mg	Antiinflammatory; transient antiplatelet effects; may cause gastritis; more prolonged duration than that of ibuprofen.
Ketorolac	Loading dose 0.3 mg/kg, then 0.25-0.3 mg/kg IV q6h to a maximum of 5 days; maximum single dose 15 mg for those < 50 kg and 30 mg for those ≥ 50 kg	Antiinflammatory; reversible antiplatelet effects; may cause gastritis; useful for short-term situations in which oral dosing is not feasible.
Diclofenac sodium	2-3 mg/kg/day divided in 2 or 3 doses *Maximum daily dose:* 150 mg	Antiinflammatory; reversible antiplatelet effects; lower risk of gastritis and ulceration compared with other NSAIDs.
Celecoxib	Only approved for children ≥2 yr; ≥10 kg to ≤25 kg: 50 mg PO bid >25 kg: 100 mg PO bid	Antiinflammatory; no or minimal antiplatelet or gastric effects; cross-reactivity with sulfa allergies.

Opioids

- The term “narcotics” (narcotic analgesics) should be avoided.
- Moderate and severe pain:
  - acute postoperative pain
  - pain from trauma
  - sickle cell crisis pain
  - cancer pain.
- There is no “right” dose for everyone.
- The right dose is the dose that relieves pain with a good margin of safety.
-

Common side effects:

- Sedation
- Constipation
- nausea, vomiting
- urinary retention
- Pruritus
- Addiction
- respiratory depressant effects
- Painful IM injection.

Opioids

Morphine:

- 0.05 mg/kg q2-4h

Fentanyl:

0.5- 1 µg/kg q1-2h

Methadone:

0.1 mg/kg q8-24h

Table 93.7 Pediatric Dosage Guidelines for Opioid Analgesics

DRUG	EQUI-ANALGESIC DOSES		PARENTERAL DOSING		IV:PO DOSE RATIO	ORAL DOSING		COMMENTS
	IV	ORAL	<50 kg	≥50 kg		<50 kg	≥50 kg	
Fentanyl	10 µg	100 µg	0.5-1 µg/kg q1-2h 0.5-1.5 µg/kg/hr	0.5-1 µg/kg q1-2h 0.5-1.5 µg/kg/hr	Oral transmucosal: 1:10 Transdermal: 1:1	Oral transmucosal: 10 µg/kg Transdermal: 12.5-50 µg/hr	Transdermal patches available; patch reaches steady state at 24 hr and should be changed q72h	70-100 times as potent as morphine with rapid onset and shorter duration. With high doses and rapid administration, can cause chest wall rigidity. Useful for short procedures; transdermal form should be used only in opioid-tolerant patients with chronic pain.
Hydrocodone	N/A	1.5 mg	N/A	N/A	N/A	0.15 mg/kg	10 mg	Weak opioid; only available in form with acetaminophen.
Hydromorphone	0.2 mg	0.6 mg	0.01 mg q2-4h 0.002 mg/kg/hr	0.01 mg q2-4h 0.002 mg/kg/hr	1:3	0.04-0.08 mg/kg q3-4h	2-4 mg q3-4h	Five times the potency of morphine; no histamine release and fewer adverse events than morphine.
Methadone	1 mg	2 mg	0.1 mg/kg q8-24h	0.1 mg/kg q8-24h	1:2	0.2 mg/kg q8-12h PO; available as liquid or tablet	2.5 mg TID	Duration 12-24 hr; useful in certain types of chronic pain; requires additional vigilance because it will accumulate over 72 hr and produce delayed sedation. When patients tolerant of opioids are switched to methadone, they show incomplete cross-tolerance and improved efficacy. Because methadone is associated with prolonged QTc, monitoring is needed for children receiving high and extended dosing.
Morphine	1 mg	3 mg	0.05 mg/kg q2-4h 0.01-0.03 mg/kg/hr	0.1 mg/kg q2-4h 0.01-0.03 mg/kg/hr	1:3	Immediate release: 0.3 mg/kg q3-4h Sustained release: 20-35 kg: 10-15 mg q8-12h 35-50 kg: 15-30 mg q8-12h	Immediate release: 15-20 mg q3-4h Sustained release: 30-90 mg q8-12h	Potent opioid for moderate/severe pain; may cause histamine release. Sustained-release form must be swallowed whole; if crushed, becomes immediate acting, leading to acute overdose.
Oxycodone	N/A	3 mg	N/A	N/A	N/A	0.1-0.2 mg q3-4h; available in liquid (1 mg/mL)	Immediate release: 5-10 mg q4h Sustained release: 10-120 mg q8-12h	Strong opioid only available as an oral agent in North America; more potent than and preferable to hydrocodone. Sustained-release form must be swallowed whole; if crushed, becomes immediate acting, leading to acute overdose.

N/A, not available

Pharmacological terms

Dependence refers to the need for continued drug dosing to prevent abstinence syndrome when a drug is abruptly discontinued or its dose reduced.

Abstinence syndrome is characterized by irritability, agitation, autonomic arousal, nasal congestion, piloerection, diarrhea, jitteriness, and yawning; it is produced by administration of potent opioids for >5-7 days.

Addiction, a psychiatric pathology, refers to psychologic craving, compulsive drug-seeking behavior, and drug use despite medical harm. Addiction has strong genetic and environmental determinants. Opioid therapy will not lead to addiction innonsusceptible individuals, and opioid underdosing does not prevent addiction; it may in fact increase drug-seeking behavior for relief of pain (e.g., watching the clock), referred to as “pseudoaddiction.”

CDC Practice Guideline for Prescribing Opioids for Pain (2022) Excluding Sickle Cell Anemia, Cancer, Palliative Care and End of Life Care

DETERMINING WHETHER OR NOT TO INITIATE OPIOIDS FOR PAIN
All patients with pain should receive treatment that provides the greatest benefits relative to risks.

Recommendation 1

Clinicians should maximize use of nonpharmacologic and nonopioid pharmacologic therapies as appropriate for the specific condition and patient and only consider opioid therapy for acute pain if benefits are anticipated to outweigh risks to the patient.

Nonopioid therapies are at least as effective as opioids for many common types of acute pain.

Before prescribing opioid therapy for acute pain, clinicians should discuss with patients the realistic benefits and known risks of opioid therapy.

CDC Practice Guideline for Prescribing Opioids for Pain (2022) Excluding Sickle Cell Anemia, Cancer, Palliative Care and End of Life Care

Recommendation 2
Nonopioid therapies are preferred for subacute and chronic pain.

SELECTING OPIOIDS AND DETERMINING OPIOIDS DOSAGES
Recommendation 3
When starting opioid therapy for acute, subacute, or chronic pain, clinicians should prescribe immediate-release opioids instead of extended-release and long-acting (ER/LA) opioids.

Recommendation 4
When opioids are initiated for opioid-naive patients with acute, subacute, or chronic pain, clinicians should prescribe the lowest effective dosage.

CDC Practice Guideline for Prescribing Opioids for Pain (2022) Excluding Sickle Cell Anemia, Cancer, Palliative Care and End of Life Care

Recommendation 5
For patients already receiving opioid therapy, clinicians should carefully weigh benefits and risks and exercise care when changing opioid dosage.
with an appropriately taper and discontinue opioids.

DECIDING DURATION OF INITIAL OPIOID PRESCRIPTION AND CONDUCTING FOLLOW-UP
Recommendation 6
When opioids are needed for acute pain, clinicians should prescribe no greater quantity than needed for the expected duration of pain severe enough to require opioids.

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Recommendation 7
Clinicians should evaluate benefits and risks with patients within 1–4 weeks of starting opioid therapy for subacute or chronic pain or of dosage escalation. Clinicians should regularly reevaluate benefits and risks of continued opioid therapy with patients.

CDC Practice Guideline for Prescribing Opioids for Pain (2022) Excluding Sickle Cell Anemia, Cancer, Palliative Care and End of Life Care

ASSESSING RISK AND ADDRESSING POTENTIAL HARMS OF OPIOID USE

Recommendation 8

Before starting and periodically during continuation of opioid therapy, clinicians should evaluate risk for opioid-related harms and discuss risk with patients. Clinicians should work with patients to incorporate into the management plan strategies to mitigate risk, including offering naloxone.

Recommendation 9

When prescribing initial opioid therapy for acute, subacute, or chronic pain, and periodically during opioid therapy for chronic pain, clinicians should review the patient's history of controlled substance prescriptions using state prescription drug monitoring program (PDMP) data to determine whether the patient is receiving opioid dosages or combinations that put the patient at high risk for overdose.

CDC Practice Guideline for Prescribing Opioids for Pain (2022) Excluding Sickle Cell Anemia, Cancer, Palliative Care and End of Life Care

Recommendation 10
When prescribing opioids for subacute or chronic pain, clinicians should consider the benefits and risks of toxicology testing to assess for prescribed medications as well as other prescribed and nonprescribed controlled substances.
Recommendation 11
Clinicians should use particular caution when prescribing opioid pain medication and benzodiazepines concurrently and consider whether benefits outweigh risks of concurrent prescribing of opioids and other central nervous system depressants.
Recommendation 12
Clinicians should offer or arrange treatment with evidence-based medications to treat patients with opioid use disorder.
Detoxification on its own, without medications for opioid use disorder, is not recommended for opioid use disorder because of increased risks for resuming drug use, overdose, and overdose death.

Summary of FDA Recommendations codeine and tramadol

- no codeine or tramadol for:
  - less than 12 years
  - obese patients
  - in breastfed women.
- Use of tramadol for treatment of pain after tonsillectomy or adenoidectomy in patients <18 yr old is contraindicated. (Codeine was already contraindicated in such patients.)

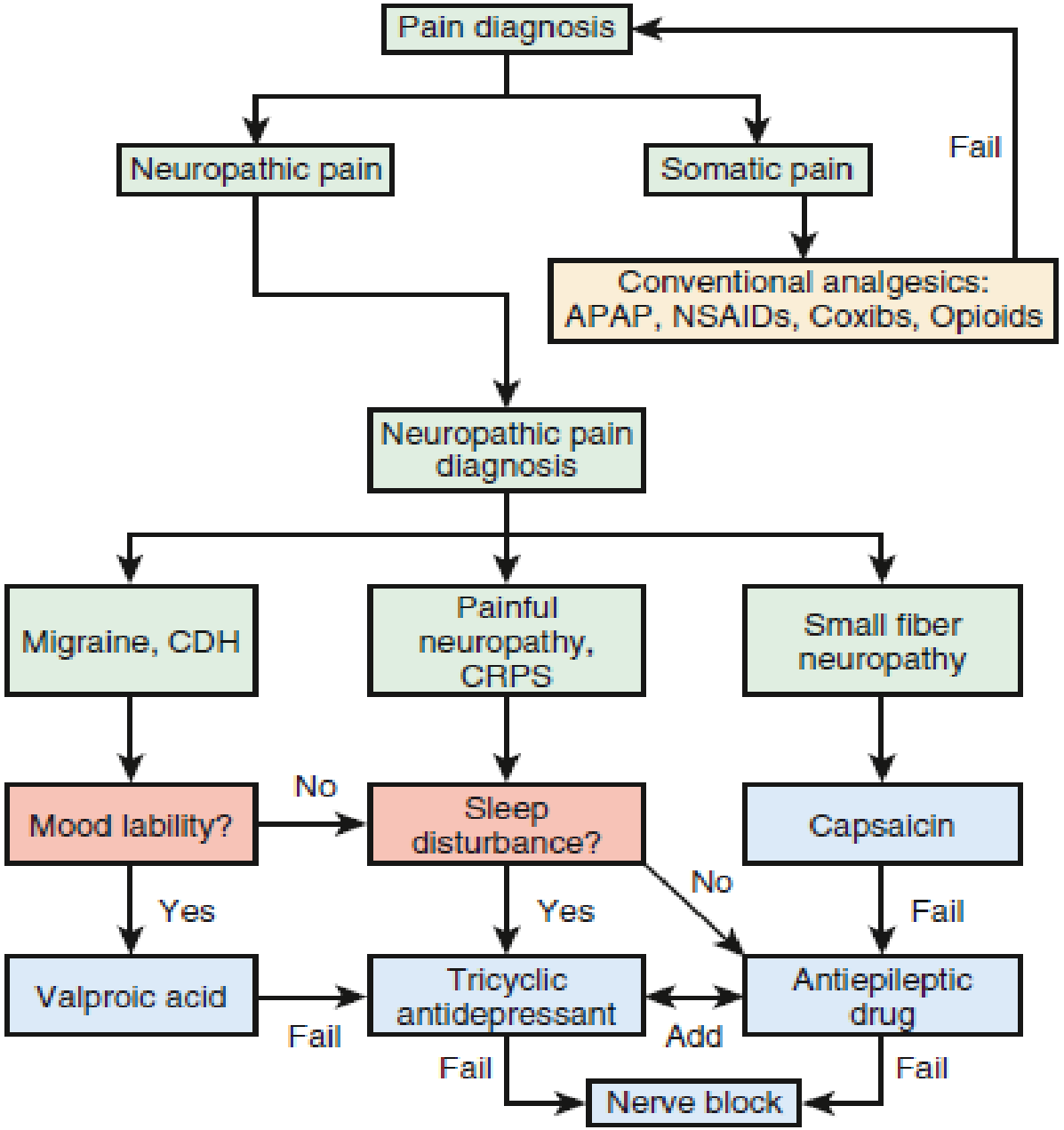

Fig. 93.4 Algorithm for selection of conventional and nonconventional analgesics. APAP, Acetaminophen; CDH, chronic daily headaches; CRPS, complex regional pain syndrome; NSAIDs, nonsteroidal antiin-

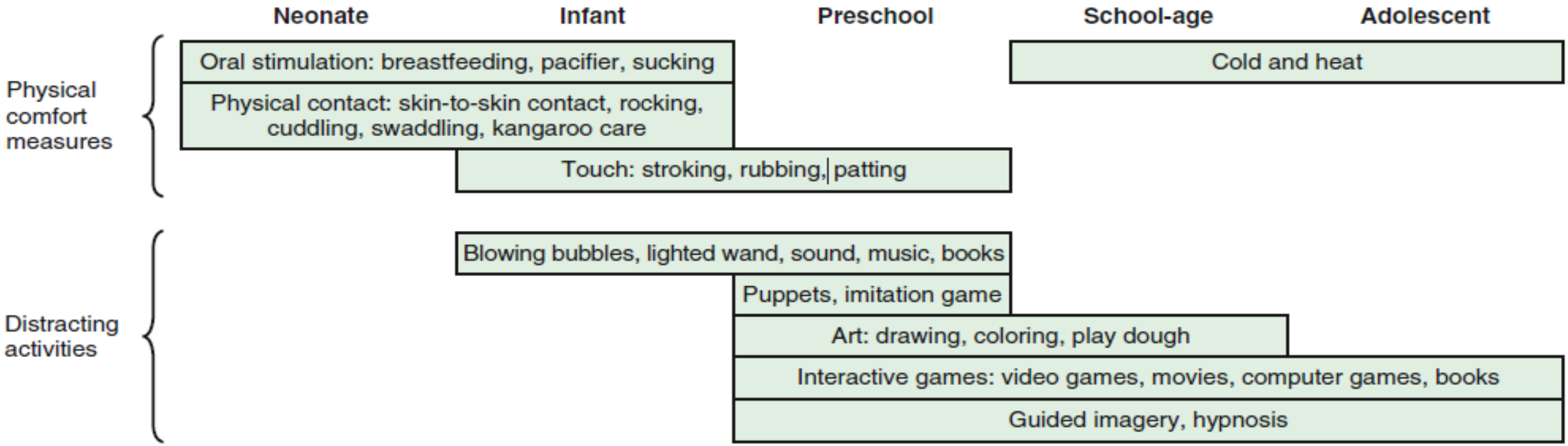

Fig. 93.5 Nonpharmacologic interventions for pediatric pain. *(From Krauss BS, Calligaris L, Green SM, Barbi E. Current concepts in management of pain in children in the emergency department. Lancet. 2016;387:83–92.)*

THANK YOU